

REMARKS

Claims 1 through 9 are currently pending in the application.

This amendment is in response to the Office Action of November 8, 2001.

Applicant has amended claims 1, 3, 5, 6 and 8, and respectfully requests reconsideration of the application as amended herein.

Applicant notes the filing of three Information Disclosure Statements herein on April 12, 2001, July 10, 2001 and October 17, 2001 and notes that copies of the PTO-1449s were not returned with the outstanding Office Action. Applicant respectfully requests that the information cited on the PTO-1449 be made of record herein.

35 U.S.C. § 112, First Paragraph, Claim Rejections

Claims 3 through 5, 8 and 9 were rejected under 35 U.S.C. § 112, first paragraph as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor, at the time the application was filed, had possession of the claimed invention.

Applicant has amended the claimed invention as suggested by the Examiner for the presently claimed invention to particularly point out and distinctly claim the subject matter of the invention to comply with the provisions of 35 U.S.C. § 112. Therefore, presently amended claims 3 through 5, 8 and 9 are allowable under the provisions of 35 U.S.C. § 112. Specifically, independent claim 3, as amended herein, now recites, inter alia “a gel elastomer contacting at least a portion of the back side surface of the semiconductor die, wherein the gel elastomer is compliant, adhesive, and filled with a thermally conductive material.” Independent claim 8, as amended herein, now recites, inter alia “a gel elastomer contacting a portion of the back side surface of the semiconductor die, wherein the gel elastomer is a cross-linked silicon gel, compliant, adhesive, and filled with a thermally conductive material.” Applicant’s specification at page 8, paragraph 34, states the “[t]he gel-elastomer 50 is a recently developed material and includes Heat Path™ filled cross-linked silicone gels sold by Raychem. As used in this

invention, the gel elastomer 50 is filled with a conductive material to provide high thermal conductivity. The gel elastomer material is compliant under light pressure, has a solid shape retention, cohesive strength and the ability to wet and adhere to surfaces.” (Emphasis added.) Thus, Applicant submits that ample support for the gel elastomer is provided in Applicant’s specification as to enable one skilled in the art to make and use the invention as claimed in now amended independent claims 3 and 8 and the amendments to the claimed invention clearly comply with the provisions of 35 U.S.C. § 132 as no new matter has been added to the application.

Therefore, claims 3 through 5, 8 and 9 clearly comply with the provisions of 35 U.S.C. § 112, paragraph one. Applicant respectfully requests that the rejection of claims 3 through 5, 8 and 9 be withdrawn.

35 U.S.C. § 112, Second Paragraph, Claim Rejections

Claims 3 through 5, 8 and 9 were rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicant regards as the invention.

As discussed above, Applicant has amended claims 3, 5 and 8 to remove the unclear language so as to particularly point out and distinctly claim the subject matter regarded as the invention. As amended, claims 3 and 8 now clearly describe the elastomer gel as “compliant, adhesive, and filled with a thermally conductive material.” Thus, the elastomer gel is compliant, the elastomer gel is adhesive and the elastomer gel is filled with a thermally conductive material. Claims 5 and 8 further describe the elastomer gel as “a cross-linked silicon gel.” Applicant respectfully submits that cross-linked molecules are well known in the chemistry or material science arts. Further, according to *Webster's Third New International Dictionary*, 542 (Merriam-Webster Inc. 1986), a definition for “cross-link” is as follows: “a comparatively short connecting unit (as a chemical bond or a chemically bonded atom or group) between neighboring chains of atoms in a complex chemical molecule (as a polymer).” As such, the term “cross-linked silicon

“gel” as used in amended claims 5 and 8 corresponds to the plain meaning defined in the dictionary.

Therefore, claims 3 through 5, 8 and 9 clearly comply with the provisions of 35 U.S.C. § 112, paragraph two. Applicant respectfully requests that the rejection of claims 3 through 5, 8 and 9 be withdrawn.

35 U.S.C. § 102(e) Anticipation Rejections

Claims 1 and 6 were rejected under 35 U.S.C. § 102(e) as being anticipated by Mostafazadeh et al. reference (U.S. Patent 5,705,851). After carefully considering the cited prior art, the rejections, and the Examiner’s comments, Applicant has amended the claimed invention to clearly distinguish over the cited prior art.

A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art reference. *Verdegaal Brothers v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987). The identical invention must be shown in as complete detail as is contained in the claim. *Richardson v. Suzuki Motor Co.*, 9 USPQ2d 1913, 1920 (Fed. Cir. 1989).

Mostafazadeh et al. reference appears to disclose a heat sink which is attached to a surface of a semiconductor die and which extends through the package molding. (See Fig. 2.) However, the Mostafazadeh et al. reference does not disclose each and every element of claim 1 as now amended. Specifically, the Mostafazadeh et al. reference does not disclose “[a] semiconductor assembly comprising: a substrate having a surface . . . a semiconductor die having a plurality of edges, having an active surface having a plurality of bond pads thereon located adjacent at least two edges of the plurality of edges, and having a back side surface, the semiconductor die having at least a portion of the back side surface adhesively attached to at least a portion of the surface of the substrate . . . a gel elastomer contacting at least a portion of the active surface of the semiconductor die, an encapsulation material covering a portion of the surface of the substrate, the plurality of edges of the semiconductor die . . . and at least one

bond pad of the plurality of bond pads located adjacent at least two edges of the semiconductor die, and a heat sink attached to the gel elastomer.” As recited in now amended claim 1. (Emphasis added.) Therefore, Applicant respectfully submits that the Mostafazadeh reference does not anticipate the presently claimed invention under 35 U.S.C. § 102. Accordingly, presently amended claim 1 is allowable.

Regarding claim 6, the Mostafazadeh et al. reference does not appear to disclose each and every element of claim 6 as now amended to state “[a] semiconductor assembly comprising . . . a substrate having a plurality of electrical connections on a portion of a surface thereof; at least one semiconductor die having a plurality of bond pads on a first portion of an active surface thereof and having a back side surface, a portion of the back side surface adhesively attached to a portion of the surface of the substrate; a plurality of wire bonds connecting at least a portion of the plurality of bond pads of the at least one semiconductor die to at least a portion of the plurality of electrical connections of the substrate . . . a gel elastomer contacting a second portion of the active surface of the at least one semiconductor die . . . an encapsulant material covering a portion of the surface of the substrate, the plurality of bond pads on the active surface of the at least one semiconductor die, a portion of the active surface of the at least one semiconductor die, and the plurality of wire bonds . . . and a heat sink attached to the gel elastomer.” Therefore, Applicant respectfully submits that the Mostafazadeh et al. reference does not anticipate the presently claimed invention under 35 U.S.C. § 102. Accordingly, presently amended claim 6 is allowable.

35 U.S.C. § 103(a) Obviousness Rejections

Claims 2 and 7 were rejected under 35 U.S.C. § 103(a) as being unpatentable over the Mostafazadeh et al. reference in view of the Akram et al. reference (U.S. Patent 6,081,027).

Applicant submits that to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in

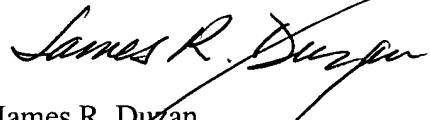
the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Third, the cited prior art reference must teach or suggest all of the claim limitations. Furthermore, the suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on Applicant's disclosure.

Applicant submits that the Mostafazadeh et al. reference, when combined with the Akram reference does not establish a *prima facie* case of obviousness under 35 U.S.C § 103 regarding the claimed invention because the cited prior art fails to teach or suggest all of the claim limitations of independent claims 1 and 6, from which claims 2 and 7 depend, respectively. As discussed above, the Mostafazadeh et al. reference does not teach or suggest "a heat sink attached to the gel elastomer," as recited in now amended claims 1 and 6. The Akram reference appears to be silent on the subject matter of a gel elastomer. Therefore, Applicant submits that the proposed combination of the cited prior art fails to establish a *prima facie* case of obviousness under 35 U.S.C. § 103 regarding the presently claimed invention of claims 2 and 7.

Accordingly, Applicant submits that claims 1 through 9 are clearly allowable over the cited prior art.

In summary, Applicant requests the allowance of claims 1 through 9 and the case passed for issue.

Respectfully submitted,



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Enclosure: Version with Markings to Show Changes Made

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APPENDIX A

VERSION WITH MARKINGS TO SHOW CHANGES MADE

IN THE CLAIMS:

A marked-up version of each of the presently amended claims, highlighting the changes thereto, follows:

1. (Twice Amended) A semiconductor assembly comprising:
a substrate having a surface;
a semiconductor die having a plurality of edges, having an active surface having a plurality of bond pads thereon located adjacent at least two edges of the plurality of edges, and having a back side surface, the semiconductor die having at least a portion of the back side surface adhesively attached to at least a portion of the surface of the substrate;
a gel elastomer contacting at least a portion of the active surface of the semiconductor die;
an encapsulation material covering a portion of the surface of the substrate, the plurality of edges of the semiconductor die, and at least one bond pad of the plurality of bond pads located adjacent at least two edges of the semiconductor die; and
a heat sink attached to [a portion of the active surface of the semiconductor die] the gel elastomer.

3. (Amended) A semiconductor assembly comprising:
a substrate having a plurality of circuits on a portion of a surface thereof;
a semiconductor die having a plurality of bond pads located on an active surface thereof and having a back side surface;
a plurality of solder balls connecting at least a portion of the plurality of bond pads of the semiconductor die to at least a portion of the plurality of circuits of the substrate;

a [compliant adhesive filled] gel elastomer contacting at least a portion of the back side surface of the semiconductor die, wherein the gel elastomer is compliant, adhesive, and filled with a thermally conductive material; and

a heat sink cap covering the [compliant adhesive filled] gel elastomer, the semiconductor die, the plurality of solder balls, and a portion of the substrate, the heat sink cap contacting at least a portion of the [compliant adhesive filled] gel elastomer.

5. (Amended) The semiconductor assembly of claim 3, wherein the [compliant adhesive filled] gel elastomer includes a cross-linked silicone.

6. (Twice Amended) A semiconductor assembly comprising:

a substrate having a plurality of electrical connections on a portion of a surface thereof; at least one semiconductor die having a plurality of bond pads on a first portion of an active surface thereof and having a back side surface, a portion of the back side surface adhesively attached to a portion of the surface of the substrate; a plurality of wire bonds connecting at least a portion of the plurality of bond pads of the at least one semiconductor die to at least a portion of the plurality of electrical connections of the substrate;

a gel elastomer contacting a second portion of the active surface of the at least one semiconductor die;

an encapsulant material covering a portion of the surface of the substrate, the plurality of bond pads on the active surface of the at least one semiconductor die, a portion of the active surface of the at least one semiconductor die, and the plurality of wire bonds; and

a heat sink attached to [a second portion of the active surface of the at least one semiconductor die] the gel elastomer.

8. (Twice Amended) A semiconductor assembly comprising:
a substrate having a surface having a plurality of circuits on a portion thereof;
a semiconductor die having a plurality of bond pads located on a first portion of an active surface
thereof and having a back side surface;
a plurality of solder balls connecting at least a portion of the plurality of bond pads of the
semiconductor die to at least a portion of the plurality of circuits of the substrate;
a [metal filled cross-linked silicone compliant adhesive filled] gel elastomer contacting a portion
of the back side surface of the semiconductor die, wherein the gel elastomer is a cross-
linked silicon gel, compliant, adhesive, and filled with a thermally conductive material;
and
a heat sink cap having a portion thereof in contact with a portion of the [metal filled cross-linked
silicone compliant adhesive filled] gel elastomer, the heat sink cap covering the [metal
filled cross-linked silicone compliant adhesive filled] gel elastomer, the semiconductor
die, the plurality of solder balls, and at least a portion of the substrate.